

REMARKS

The specification stands objected to as failing to provide proper antecedent basis for the claimed subject matter, in particular, claim 2 recites a temperature range in units of Celsius, but it appears from the specification that the units should be in Fahrenheit.

Claim 2 has been appropriately amended to change the temperature units to Fahrenheit.

Claims 1-3 stand rejected under 35 USC §103(a) as unpatentable over Duffy et al (Wet Peroxide Oxidation of Sediments Contaminated with PCBs) in view of Swallow (US 5,232,604). Duffy is cited for disclosing a method for treating low solids content sediment from a body of water, the sediment including halogenated organic contaminants, with the method comprising, from applicant's claim 1, the steps of (1) dewatering the sediment to obtain a stream of water having a concentrated solids content of 50% by weight, (2) adding air or oxygen and hydrogen peroxide to the concentrated solids stream, and (3) pressurizing the concentrated solids stream to a pressure in the range of about 1500 psi. Duffy also discloses the use of iron as a catalyst to facilitate the oxidation with hydrogen peroxide.

Duffy does not teach the addition of fuel to the concentrated solid stream, nor, with respect to the method steps of applicant's claim 1, does Duffy teach (4) preheating the pressurized stream by passing the stream through a heat exchanger, (5) conveying the preheated stream into a reactor operating at a self-sustaining temperature sufficient to dehalogenate and decompose or denatured the contaminant compounds, (6) returning the dehalogenated and decomposed or denatured stream to the heat exchange to provide heat for the preheating step, or (7) reducing the pressure of the stream for further processing. With respect to applicant's claim 2, Duffy does not teach operating the reactor at a temperature range in the range of 800°F. to 2000°F. (the units of temperature changed in accordance with the amendment above).

Swallow is cited for teaching a process for the oxidation of sediments contaminated with toxic compounds at supercritical temperatures, including the addition of a fuel to the concentrated solid stream, and the additional steps from applicant's claim 1 of (4) preheating the pressurized stream by passing the stream through a heat exchanger, (5) conveying the preheated stream into a reactor operating at a self-sustaining temperature sufficient to dehalogenate and decompose or denature the contaminant compounds, (6) returning the dehalogenated and decomposed or denatured stream to the heat exchanger to provide heat for the preheating step and (7) reducing the pressure of the stream for further processing, and adding the step from applicant's claim 2 of operating the reactor at a temperature in the range recited. Furthermore, the Examiner finds that Duffy and Swallow are analogous art because they are from the said field of endeavor, namely, processes that remove toxic materials from sediments.

The Examiner concludes that it would have been obvious to one skilled in the art to form the process of Duffy by including the addition of a fuel to the concentrated solid stream, preheating the pressurized stream by passing the stream through a heat exchanger, conveying the preheated stream into a reactor operating at a self-sustaining temperature sufficient to dehalogenate and decompose or denature the contaminant compounds, returning the dehalogenated and decomposed or denatured stream to the heat exchange to provide heat for the preheating step, and reducing the pressure of the stream for further processing, including operating the reactor in a specified temperature range of 800°F. to 2000°F.

The Examiner finds the suggestion or motivation for adding fuel in applicant's step (2) of claim 1 to offset heat loss in the reactor and to achieve a higher temperature than the reaction is capable of sustaining as taught by Swallow. Further, the motivation for applying Swallow to teach applicant's steps (4) - (7) of claim 1 would have been to rapidly heat up the incoming feed to the reactor and to not greatly affect the fuel feed value requirement by using recycled heat. Finally, the motivation to operate the

reactor in the indicated temperature range would have been to provide a complete oxidation of the reactants.

The foregoing rejections are respectfully traversed in view of the amendment to claim 1 and the comments which follow.

Duffy describes a process that uses hydrogen peroxide, iron, and oxygen or air as additives to a PCB-contaminated sediment in a standard high pressure wet air oxidation process. Applicant, on the other hand, has developed a modified high pressure wet air oxidation process for handling a high water content contaminated solids stream which includes PCBs that builds on the 1997 Base Catalyzed Dehalogenation (BCD) Process.

The BCD Process is specifically intended for use in treating a **dry** contaminated material, like soil, and not a high moisture content material like river sediment treated in applicant's process. Drying a material like river sediment would drastically change the economics of the BCD Process due to the need to mechanically and/or thermally remove the moisture that is inherent in river sediment. Applicant's basic concept is to achieve the same chemical reactions by first removing the chlorine from the PCB compounds so that the resulting biphenyl compounds can be degraded by oxidation under the conditions of high temperature and pressure so that **the water will not have to be removed prior to treatment.**

Because river sediment has a low organic content, the normal wet air oxidation process cannot operate autogenously with river sediment because there is not enough organic material present to sustain the required temperature to support the oxidation reaction and, as a result, an external heat source like steam or hot oil in a conventional heat exchanger is used to add sufficient additional heat to the process to allow the treated material to reach the required temperature. Such an external heat source will use a burner that will operate at a nominal 80% efficiency and, in addition, there will be other thermal balance inefficiencies due to heat losses from the external heating and delivery systems. This is the approach that is proposed by both Duffy and Swallow

where heat is added to the process via a separate heat exchanger (i.e., 54 in Fig. 4 - Swallow) on a continuously operating basis.

Adding a supplemental organic fuel, like fuel oil, propane or gasoline to the existing low organic, high water content sediment provides a mixture that will operate autogenously where the original material would require an external heat source, such as taught by Swallow and Duffy. The advantage of applicant's approach is that the thermal efficiency of the oxidation reaction will be 100% since the supplemental fuel will be fully oxidized under the process operating conditions, as compared to the lower combustion efficiency of the separately fueled heat exchanger of Swallow and Duffy.

The process of Swallow in Example 1 is to burn slurried coal in a high pressure reactor in order to generate steam for power production with no method of heat recovery other than the steam generated. The list of process feeds described by Swallow (column 21, lines 18-40) is most closely analogous to the oxidizable organics in the sediment stream of applicant's process and not a separately added supplemental fuel.

In a normal wet air oxidation process, when there is not enough organic material to support a self-sustaining reaction, a portion of the heat exchanger ahead of the reactor is heated by an external thermal source, such as taught by Swallow with the heat exchanger 54 in Fig. 4. River sediment is inherently low in organics due to an aerobic decomposition. Therefore, applicant's process utilizes a supplemental oxidizable fuel compound (fuel oil, propane or gasoline) to augment the concentration of organics in the available sediment sufficient to support a self-sustaining operating condition. Applicant's process does not require a separately fueled heat exchanger to support the autogenous reaction, as does Swallow and Duffy.

The economic advantage of applicant's approach is the augmented fuel will be fully oxidized for a thermal efficiency of 100% versus an 80% thermal efficiency for a separately fueled heat exchanger. In addition, the capital and operating costs for such a supplemental system, for example, recycle pumps, boiler water treatment system,

condensate return system, along with external heating system heat loss inefficiencies, all militate against the use of the approach taught by Swallow.

Amended claim 1 includes several additions that serve to further distinguish applicant's method from the combination of Duffy and Swallow. Step (1) has been amended to recite a concentrated solids content not greater than about 50% comprised of inorganic and organic fractions in order to distinguish over the dry contaminated soil material in the BCD Process. Method step (4) has been amended to make it clear that the heat exchanger is heated only by the process stream from the reactor and does not require a separate heat input to support the oxidation reaction as taught by Swallow and Duffy. Step (5) includes a clarifying addition to emphasize that the fuel addition itself is sufficient to maintain the self-sustaining reaction temperature. Claim 2 has been amended, as indicated above, to change the recited temperature range to Fahrenheit units.

Claim 6 stands rejected under 35 USC §103(a) as unpatentable over the combination of Duffy and Swallow, as applied to claims 1-3, and further in view of Rickard (US 5,103,578). Rickard is cited for teaching a process of removing organic contaminants from sediment using a barge to support the equipment used in the process. The Examiner finds that it would have been obvious to one skilled in the art to provide a first barge for the process equipment utilized in performing steps (1) and (2), providing a second barge for process equipment utilized in performing steps (3) - (7), and providing one or more low pressure process low connections between the barges.

Claim 6 is believed to be allowable along with amended claim 1 for the reasons set forth above. In addition, the steps of claim 6 provide a particularly beneficial solution to the treatment of river sediments where the stretch of river being treated may be fully developed so there is little or no opportunity for shore-based treatment facilities to work in concert with a dredge. One significant advantage of applicant's process is the ability to work on a river to destroy the PCBs and dewater the sediment before transport of the greatly reduced volume of treated sediment to locations where it can be handled

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appropriately. In addition, comparing the applicant's continuous process that destroys the PCB contaminates in river sediment under thermally efficient operating conditions is considerably different from Rickard's teachings for a thermal process that offers no energy recovery technology and only separates out the PCBs for subsequent treatment or destruction in a different, undefined process.

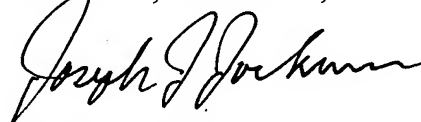
New claim 7 depends from claim 1. By adding the air or oxygen directly into the suction of the high pressure sludge pump used to pressurize the sediment, a separate high pressure compressor, typical of wet air oxidation systems, would not be required. A high pressure compressor is expensive, has a high energy input requirement, and has a high maintenance cost. Although the sludge pump will operate somewhat less efficiently in this manner, the overall capital and operating costs will be substantially reduced by eliminating the motor/compressor, related piping and high pressure check valve where the streams are combined.

Applicant gratefully notes the Examiner's indication of allowability of claims 4 and 5. However, amended claim 1 and claims 2-3 and 6 are all believed to be allowable in view of the amendment to claim 1 and the foregoing comments in support thereof.

Further favorable action is respectfully requested.

Respectfully submitted,

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